SAVANNAH RIVER SITE

321-M Fuel Fabrication Facility

Technology Post-Demonstration Fact Sheet
March 30, 1999

LONG RANGE ALPHA DETECTION (LRAD) FOR COMPONENT MONITORING

Need Description

Components that have been removed from a contamination area need to be cleared as uncontaminated for reuse or disposal when possible. The conventional method for detecting alpha contamination is the use of hand-held alpha probes and smear samples to scan the surface area. Areas that are not accessible for probing or smearing, such as the internal surfaces of small diameter pipe, may preclude free release or clean disposal of items.

Figure 1. BNFL IonSens Ô Unit with Pipe Measurement Chamber.

Innovative Technology Description

The BNFL Instruments IonSens™ Monitor measures alpha contamination on surfaces by detecting the ionized air molecules produced by the alpha particles when they interact with ambient air.

The device includes three modular units; an input filter unit, a component chamber, and a detector unit. The component chamber can be either a Large Item Monitor (with internal volume about a 1 meter cube), or Cut Pipe Monitor (about 2 meters long). Three Cut Pipe Modules can be used, giving the ability to monitor pipes and scaffold tubes up to 6 meters in length.

Air is drawn through the assembly, picking up the induced ions and delivering them to the detector unit which counts the ions and converts to a corresponding contamination level. A built-in calibration source and an onboard computer make operation simple and straightforward. The software creates a database that includes item identification, total activity, total activity standard error, time, and date.

Baseline Technology

The baseline technology for the free release of materials is a manual probe and smear survey. The surfaces of each item intended for free release must be 100% probed for contamination. Ten percent of the surface area must be smeared for transferable contamination.

Demonstration Description

The IonSens™ system was used to monitor surface contamination levels on pipes and various other items that are candidates for “free release”. The measurements using this technology were compared with the manual probe and smear baseline technology on the basis of cost, speed, reliability and sensitivity.

During the demonstration, suspected clean items and items with low levels of contamination (less than 1000 dpm/100 cm^2) were surveyed with the IonSens™ system. The free release limit for uranium, 1000 dpm/100 cm^2, was used as the release limit for the demonstration since other radionuclides were never involved with the 321-M process.

To determine the sensitivity of the system, radioactive sources of known contamination levels were monitored.

Figure 2. Pipe Measurement

Demonstration Summary

Approximately 500 items weighing 2000 lbs were monitored by the IonSens™ system. The sizes and shapes of the items varied, but fit into one section of the pipe measurement chamber. A mesh tray supported items such as hand tools and short tubular pieces that were too small for the chamber's support system. Using this setup, multiple items were monitored during a single measurement cycle. Of the 500 items monitored, approximately 300 items, or 1000 lbs, were identified for free release based on uranium free release criteria. The 300 items included approximately 500 lbs of lead with contamination levels below free release levels. A manual free release survey confirmed the IonSens™ results.

An average measurement cycle for the IonSens™ system is six minutes. A cycle includes loading the measurement chamber, monitor time, and unloading the chamber. The IonSens™ system requires occasional standardization and background checks. The detector collector plates are sensitive to dirt and foreign matter, but if kept clean, are not high maintenance. Normal system operation requires little maintenance.

Preliminary data evaluation indicates the IonSens™ system is faster than hand surveying for larger items and multiple items run in a single measurement cycle. Single item measurements of small items may be longer than the time required to hand survey the item.

The minimum sensitivity of the system using one pipe measurement chamber was 500 dpm/100 cm^2. Planned improvements of the operating software are expected to lower the sensitivity level to 200 dpm/100 cm^2.

Benefits of the IonSensÔ Monitoring System

- Foremost advantage of the IonSens™ Monitoring System is the ability to survey areas such as the internal surface of pipe where hand probe and smears are not possible.
- Provides computer printout of surveys
- Faster than hand surveys of larger items

Future Applicability

Based on the data collected during the demonstration, the Health Physics Technology department at SRS is fully supportive of the IonSens™ system. The first phase of full acceptance will allow the system to be used as a screening tool to identify items for free release. Additional production experience will be needed for acceptance as an alternative to hand surveys. When operating software is available to measure contamination levels approaching the release levels of plutonium and other radionuclides, further evaluation will be made for those purposes.

Contact Persons

John Duda, FETC, (304) 285-4217; e-mail: **jduda@fetc.doe.gov**

Martin Salazar, DOE-SR, (803) 557-3617; e-mail: **martin.salazar@srs.gov**

Cecil May, WSRC, (803) 725-5813; e-mail: **cecil.may@srs.gov**

Jeff Lee, WSRC, (803) 725-0652; e-mail: **jeffreyw.lee@srs.gov**

Saleem Salaymeh, WSRC, (803) 725-1628; e-mail: **saleem.salaymeh@srs.gov**

Fred Gardner, BNFL Instruments, (423) 675-6853; e-mail: **fgardner@usit.net**